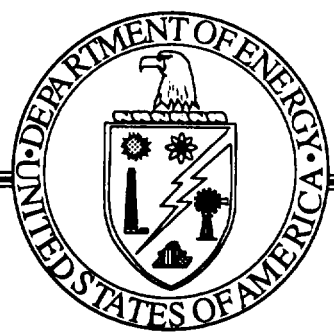
APPENDIX E

FIELD VERIFICATION REPORT
OAK RIDGE RESERVATION
APRIL 18-26, 1994



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EXECUTIVE SUMMARY

This report presents the results of a review of chemical safety vulnerabilities associated with facilities owned or operated by the Department of Energy (DOE) at the Oak Ridge Reservation. The field verification visit took place on April 18–26, 1994, and was part of the Chemical Safety Vulnerability Review being conducted by the Office of Environment, Safety and Health at the direction of the Secretary of Energy. The purpose of the review is to identify and characterize conditions or circumstances involving potentially hazardous chemicals at DOE sites and facilities. Specifically, the review is designed to identify, characterize, and prioritize chemical safety vulnerabilities that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to chemicals, or (3) releases of chemicals to the environment.

Activities involving the use, handling , transportation, and storage of hazardous chemicals at Oak Ridge include production-related processes and operations; laboratory processes; long-term, large-scale storage; and the treatment and disposal of hazardous wastes. Field verification activities at Oak Ridge included all elements of the lines of inquiry developed for the Chemical Safety Vulnerability Review. All facilities included in the Oak Ridge self-evaluations were reviewed, and additional facilities were reviewed when further information was needed.

The Oak Ridge field verification was conducted with a view toward identifying possible DOE-wide chemical safety vulnerabilities. Five chemical vulnerabilities were identified, none of which represents a condition with severe potential consequences in the near term:

- Uncharacterized areas containing potentially hazardous materials are increasingly accessible;

- Chemicals are stored in facilities not designed for that purpose;

- Facilities were placed in caretaker status without appropriate cleanup or documentation;

- Inconsistent formality and rigor are applied to managing hazardous materials; and

- Large quantities of specialty and other industrial chemicals are stored without consistent strategic planning.

These vulnerabilities, along with those identified at other DOE sites in the next phase of the Chemical Safety Vulnerability Review, will be evaluated to identify DOE-wide generic vulnerabilities. Information from the ongoing Surplus Facilities Inventory Assessment and the extended review of facilities where there may be organic-nitrate Vulnerabilities (similar to those at Tomsk-7) will also be considered. Work products from these other activities will be reviewed and may provide additional insights on possible chemical safety vulnerabilities.

Chemical safety vulnerabilities identified at each site are made available for use in developing management response plans, which in turn will provide input for the DOE-wide management response plan.

The field verification team has also identified the following commendable practices related to chemical safety at Oak Ridge:

- The use of the Hazardous Materials Information System and a computer-based bar-coding system to inventory and track hazardous chemicals and wastes, and

- Significant efforts to screen and analyze hazards at each of the Oak Ridge sites.

1.0 INTRODUCTION

1.1 Purpose and Scope

Based on direction from the Secretary of Energy, the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to review and identify chemical safety vulnerabilities within the Department of Energy (DOE). The information obtained from the review will provide the Working Group with valuable input for identifying generic chemical safety vulnerabilities that confront the DOE complex. Identifying and prioritizing generic chemical safety vulnerabilities will enhance the Department's focus on programs, funding, and policy decisions related to chemical safety. The Secretary directed the Office of Environment, Safety and Health to lead this review, with the full participation of DOE line programs having operational responsibilities.

The Chemical Safety Vulnerability Review was designed and undertaken to identify and characterize adverse conditions and circumstances involving potentially hazardous chemicals at facilities owned or operated by the Department. Specifically, the review was designed to identify, characterize, and prioritize chemical safety vulnerabilities that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to hazardous chemicals, or (3) release of hazardous chemicals to the environment. Using input provided by line organizations with operational responsibilities, the Working Group developed a project plan' to guide the review.

This report documents activities related to the field verification phase of the Chemical Safety Vulnerability Review. The field verification process was designed to use independent teams of technical professionals with experience in a variety of technical disciplines to verify the accuracy and completeness of the data compiled during the field self-evaluation phase of the review. The field self-evaluation process used a standardized question set developed and distributed by the Working Group to collect data related to chemical safety from 84 facilities at 29 sites. Based on review of this information, nine sites, including the Oak Ridge Reservation, were selected to participate in the field verification phase of the review.

The field verification team visiting Oak Ridge examined a broad range of facilities (based on facility type and operational status), with special attention given to those facilities being transferred to, awaiting, or undergoing decontamination and decommissioning (D&D). Several types of chemical- and waste-handling facilities—including laboratories, process facilities, landfills, waste treatment and storage facilities, and hazardous materials storage facilities—were examined. (See Section 1.3 for a listing of the key facilities examined.)

The field verification team, under the direction of a DOE team leader, was composed of DOE and contractor personnel with technical expertise in various aspects of chemical safety, including management and operations, training, chemical process safety, industrial hygiene, maintenance, environmental protection, and emergency preparedness. A team composition list is provided in Attachment 1 of this appendix.

' "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994.

The team began its review by visiting each of the sites selected for field verification. The team met with management or technical representatives from each of the Oak Ridge facilities reviewed. Individual and small group meetings were also held, and team members conducted facility walkthroughs, document reviews, and personnel interviews to gather information related to potential chemical safety vulnerabilities at Oak Ridge. The team leader met daily with local DOE and contractor management to discuss the team's activities and to review issues that may have surfaced during the previous day. Before the field verification team left Oak Ridge, DOE and contractor management conducted an onsite factual accuracy review of the draft report. An outbriefing was conducted on Tuesday, April 26, 1994, and a draft copy of this report was transmitted to the Oak Ridge Operations Office (OR).

1.2 **Site Description**

The Oak Ridge Reservation is situated in Roane and Anderson Counties, Tennessee, about 30 miles west of Knoxville and adjacent to the city of Oak Ridge. The Reservation comprises about 35,000 acres and includes three major sites: the K-25 Site, the Oak Ridge Y-1 2 Plant, and Oak Ridge National Laboratory (ORNL). (See Figures 1 and 2.) Most of the facilities associated with ORNL are located at X-10 Site, although some ORNL divisions are located at Y-1 2 and K-25. Some facilities at all three Oak Ridge sites were originally constructed during World War II. Martin Marietta Energy Systems (MM ES) has been the principal management and operating contractor for Oak Ridge since 1984.

Located west of the city of Oak Ridge, the K-25 Site began operations in 1945 as the Oak Ridge Gaseous Diffusion Plant. K-25's original mission was to enrich the uranium-235 isotope for use in atomic weapons. The site was subsequently used to supply fuel for the commercial nuclear power industry. DOE shut down gaseous diffusion operations at the K-25 Site in 1985, and the site was placed on the Department's list of facilities designated for D&D. The site includes 118 buildings. The K-25 Site now serves as the center of operations for MMES'S environmental restoration and waste management programs, as well as for the DOE Center for Environmental Technology and the Center for Waste Management. Key activities at K-25 include technology development, technology transfer, and engineering technology.

The Y-1 2 Plant is located in the eastern part of the Oak Ridge Reservation, adjacent to the city of Oak Ridge. The plant complex consists of about 450 buildings. The original mission of the Y-1 2 Plant was the separation of uranium-235 through use of an electromagnetic process. The plant subsequently played a key role in the manufacture of weapons components. Y-12's current mission is to operate as a manufacturing center for the development and demonstration of unique materials, components, and services for DOE and for customers approved by DOE. Principal activities involve the production, reclamation, and storage of nuclear materials; the manufacture of defense components; and support for national security programs.

Bordered by the Clinch River to the south and west, ORNL was established in 1942 to produce and separate chemically the first gram quantities of plutonium for the atomic bomb. Current programs at ORNL focus on basic and applied research, technology development, and work for others. Key ORNL activities in support of DOE include energy production and conservation technologies, physical and life sciences, scientific and technological user

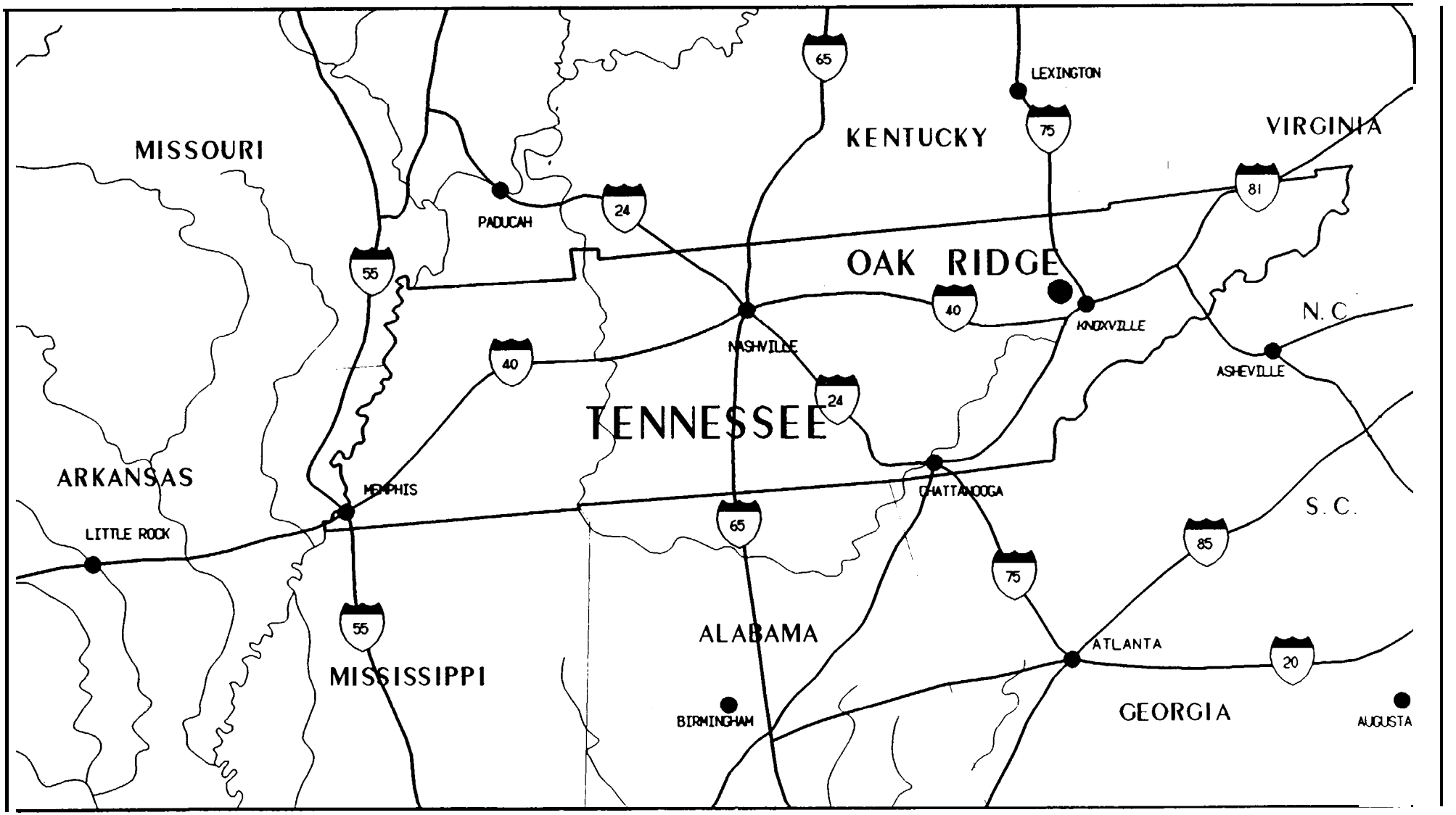

FIGURE 1. OAK RIDGE LOCATION

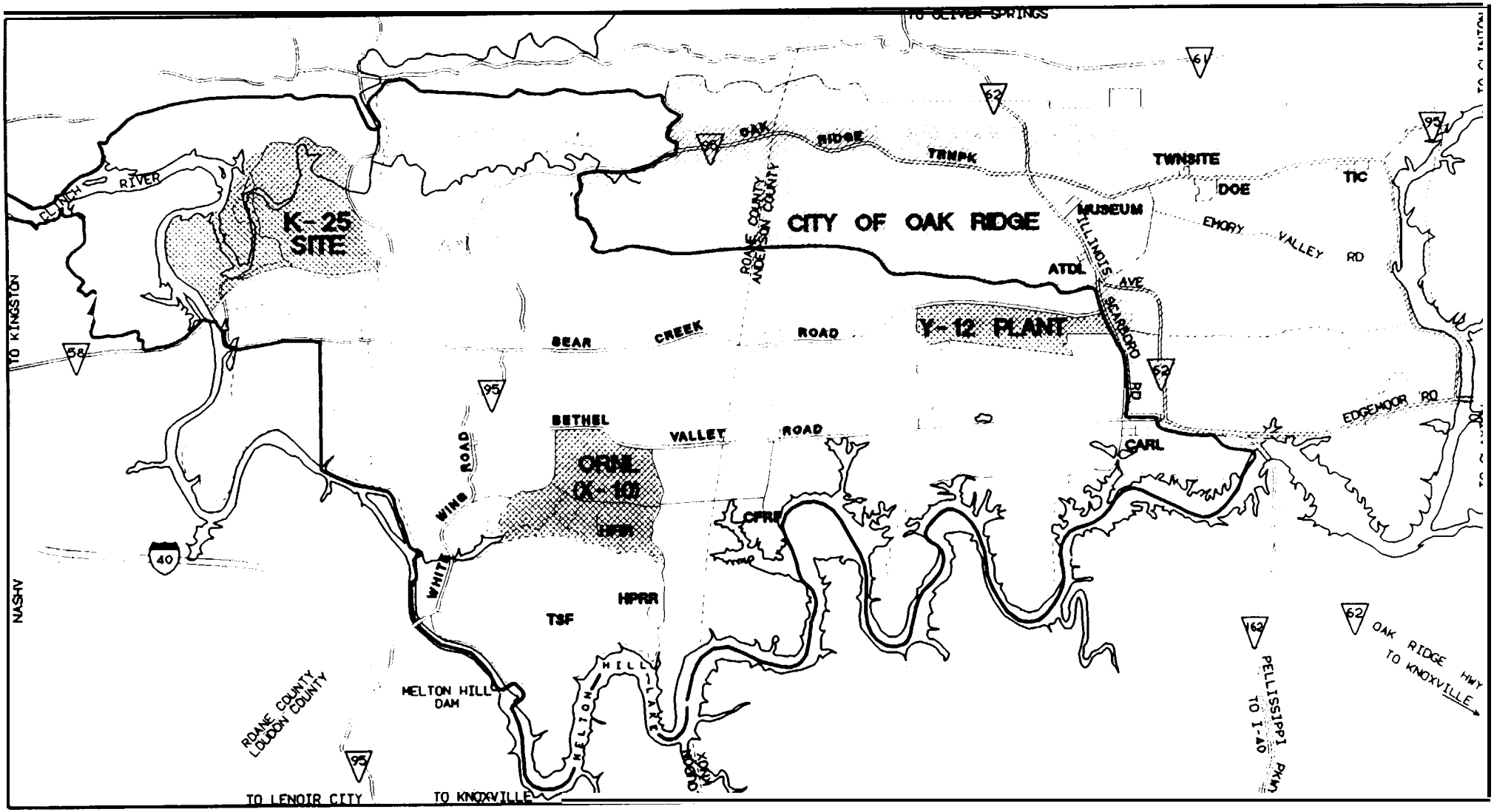

FIGURE 2. OAK RIDGE RESERVATION AND CITY OF OAK RIDGE

facilities, environmental protection and waste management, and science and technology transfer.

1.3 Facilities Visited

The field verification team visited facilities at all three Oak Ridge sites. The tables provided in this subsection identify key facilities visited by members of the-verification team and include information related to the physical condition and mission of each facility.

Table 1. Key Facilities Visited at K-25 Site.

FACILITY	MISSION	DESCRIPTION
K-107O-A Burial Ground*	Waste disposal	The 2-acre burial ground contains two distinct burial areas: trenches and waste pits. The trenches are long, narrow excavated areas in which waste was placed, then covered with soil. A typical trench measures 11 x 3 x 108 feet. Waste materials are placed in auger holes 3 feet in diameter and about 12 feet deep.
K-25 Process Building	Designed for the isotopic enrichment of uranium by the gaseous diffusion process.	Placed in operation in August 1945, the K-25 Process Building is a steel-frame structure with cement/asbestos composite siding. It is a three-level, U-shaped building with concrete floors. The length around the U is 4,975 feet. The width of the building varies around the U, with a maximum width of about 400 feet. The facility was shut down in 1964.
Lithium Storage Vaults'	Waste/environmental remediation	The lithium storage areas are located in the basement of the K-25 Process Building. A typical "vault" (i.e., a large open area) measures 300 x 61 feet.
Pond Waste Management Project*	Waste storage	The Pond Waste Management Project comprises the K-1 417-A and K-1 41 7-B Drum Storage Yards, K-305 Vaults 19-A and 19-B, and K-1419.
K-725, Beryllium Building	Support for thermal diffusion process	This building was originally designed to support the S-50 Thermal Diffusion Plant. Soon after initiation of operations, a second concrete pad was placed over the original floor because of high alpha counts from depleted uranium handled in the building. From 1946 to 1952, the building was used for the Nuclear Energy for Propulsion of Aircraft Project. The building is believed to be contaminated with beryllium, uranium, and mercury.
K-1066, Storage Yarda	Uranium hexafluoride cylinder storage	The storage yards consist of concrete or gravel pads with uranium hexafluoride cylinders stored on wooden saddles or directly on the concrete or gravel.

Facilities marked with an asterisk (') were included in the self-evaluation process.

Table 2. Key Facilities Visited at Y-12 Plant.

FACILITY	MISSION	DESCRIPTION
Building 1405 (Johnson Control World Services)	Potable water supply for the city of Oak Ridge, Y-12, and ORNL	The plant was placed in service in the mid-1940s and has been upgraded twice, once in the 1960s and again in the 1980s. The plant has a maximum capacity of 28 million gallons per day (MGD) and is currently operating at about 15 MGD.
Building 9201-4 (Alpha-4)*	Waste/environmental remediation	Placed in operation in 1945, Building 9201-4 is a 600,000-square-foot structure fabricated of reinforced concrete, structural steel, transite siding, and double-clay tile walls. The three-story building is classified as a containment facility.
Building 9201-5 (Alpha-5)	Storage	Building 9201-5 was constructed in 1946 as a primary production facility. The 530,000-square-foot building is constructed of reinforced concrete with a steel frame and masonry walls. Alpha-5 is currently used for material storage.
Building 9202	Research and development	Placed in operation in 1954, Building 9202 is a 123,800-square-foot structure of reinforced concrete with frame and masonry walls. It houses numerous chemical laboratories.
Main Warehouse, Building 9720-5'	Warehouse	The Main Warehouse was built in 1944 to provide a storage area for enriched uranium parts and materials used in nuclear weapons and for other items containing special nuclear material. The building includes about 60,000 square feet of storage space, plus 8,000 square feet of vault storage.

Facilities marked with an asterisk ~) were included in the self-evaluation process,

Table 3. Key Facilities Visited at ORNL.

FACILITY	MISSION	DESCRIPTION
Building 3047	Radioisotope separation	Building 3047 is a three-story steel-frame building with concrete-block exterior and interior walls. It was constructed in 1962 to support research and development and the production of radioisotopes. The beta-gamma area includes hot cells, the operating areas, a decontamination room, a roof plug access area, and three low-level laboratories. The hot-cell area contains four high-level beta-gamma hot cells with 3 feet of high-density concrete or equivalent attenuation of steel and concrete. Each hot cell is equipped with oil-filled lead glass shielded viewing windows with shielding equal to that of the walls.
Waste Evaporator Facility, Building 3506"	Waste/environmental remediation	The Waste Evaporator Facility was built in 1949 and shut down in 1954. The facility consists of a gallery area and a hot cell. The gallery is constructed mostly of wood, with dimensions of about 32 x 9 x 10 feet. The cell is about 28 x 13 x 16 feet, with concrete walls of varying thickness (2–3 feet) and a stainless steel floor pan.
Contractor Landfill, Building 7658*	Above-ground storage for noncontaminated scrap metal dumpsters	The Contractors Landfill was used to bury general construction debris and demolition waste generated by ORNL contractors. No waste-specific records were kept on landfill operations, and no administrative controls were maintained, The landfill measures about 500 x 260 feet and covers an area of about 3 acres. The top of the landfill is currently being used for storing scrap metal containers.
Emergency Waste Basin, Building 7821*	Process waste storage	The Emergency Waste Basin is an emergency holding basin for radioactive process waste from ORNL. The basin, which has a surface area of about 0.6 acre and a capacity of about 2.8 million gallons, has never been used.

Facilities marked with an asterisk (") were Included in the self-evalua[lon process

2.0 SUMMARY OF RESULTS

The field verification process was designed to use independent teams of safety professionals to verify the accuracy and completeness of data provided to the Chemical Safety Vulnerability Working Group concerning Oak Ridge facilities selected for field self-evaluation. The verification process offers an opportunity to examine potential chemical safety vulnerabilities and to make informed judgments about the possible relevance of these conditions for determinations of generic chemical safety vulnerabilities.

The goal of the field verification team was to identify chemical safety vulnerabilities at Oak Ridge. Before arriving on site, team members reviewed the self-evaluation data and other documents to develop lists of potential vulnerabilities for their functional areas. During the onsite portion of the review, team members visited facilities selected for self-evaluation to verify reported observations and to look for other conditions or circumstances that might result in chemical safety vulnerabilities. In some instances, facilities or areas that were not included in the original self-evaluation were also reviewed. In these cases, team members coordinated with their site counterparts to arrange for the appropriate walkthroughs or interviews. Completed chemical safety vulnerability forms resulting from the field verification activities at Oak Ridge are provided in Attachment 2 of this appendix.

To support effective team management and to expedite the identification of vulnerabilities across a wide range of technical disciplines associated with chemical safety, the field verification review was organized to include five functional areas:

- Identification of chemical holdings, including the properties of chemicals located at the facility, the characterization of those chemicals, and an analysis of the inventory.

- Facility physical condition, inciting engineered barriers, maintenance conditions, chemical systems, safety systems, storage, monitoring systems, and hazards identification.

- Operational control and management systems, including organizational structure; requirements identification; hazard analysis; procedural adherence; maintenance control; engineering and design reviews; configuration control; safe shutdown plans; and site programs for quality assurance, chemical safety, inventory control, access control, disposal, transportation and packaging, and corrective actions.

- Human resource programs, including technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor control.

- Emergency management program, including the emergency plan, inplant consequences, environmental issues, coordination with the community, and community right-to-know issues.

These functional areas were evaluated based on lines of inquiry provided in Attachment 1 of the “Field Verification Guide for the Chemical Safety Vulnerability Review,” dated April 8, 1994.

2.1 Identification of Chemical Holdings

Verification activities for the chemical holdings functional area of the Chemical Safety Vulnerability Review for the Y-1 2, K-25, and ORNL sites at Oak Ridge included all elements of the lines of inquiry. All facilities included in the site self-evaluations were reviewed. Additional facilities were reviewed whenever further information was needed.

A hazards screening of chemical usage at Oak Ridge was conducted during the initial phase of the Safety Analysis Report Update Program (SARUP) and is used by the sites as a safety basis to identify chemical hazards. Inventories of chemicals are maintained for all Oak Ridge facilities, with the methodology ranging from comprehensive computer data bases (Hazardous Materials Information System, or HMIS) to lists kept manually. When used properly, electronic data bases are highly effective tools to enhance safety and control inventories, but hand-kept lists have not proven to be as effective. A variety of problems can arise when manual and/or mixed inventory methodologies are used. For example, one Oak Ridge laboratory facility using two different manual systems and an in-house data base system did not keep track of inventory totals, with the possible (but unlikely) result that the allowable load of flammable materials in the fire zone could be exceeded. Site requirements and procedures for hazardous materials in laboratories at Oak Ridge are generally less formal and less rigorous, particularly in the area of conduct of operations, than for most other facility categories

All chemical requisitions at Oak Ridge are screened by industrial hygiene personnel for hazards, and chemicals are entered into HMIS (where used) and properly labeled (with material safety data sheet [MSDS] labels) before distribution.

A concerted effort has been made to reduce the total of the very large quantities of some chemicals (e.g., mercury lithium compounds, lubricating oils, and Freon) at Oak Ridge, and it has been successful in some cases. However, less attention has been given to smaller excess inventories of many other chemicals, including laboratory reagents that pose significant hazards. Recent efforts, though, have been initiated to develop a reservation-wide program addressing excess chemicals.

Unquantified and sometimes uncharacterized inventories of chemicals exist in inactive facilities at Oak Ridge. In the past, a number of facilities were deactivated on short notice and were not completely deinventoried. Some remediation efforts are under way, but because of potential time-dependent instabilities and the loss of corporate knowledge, the activity is now more costly and possibly more hazardous.

Storage of chemicals at Oak Ridge is largely in compliance with site procedures and with relevant regulations that require appropriate labels and segregation according to class. Very large quantities of chemicals are warehoused in shutdown production facilities that were not originally designed for this purpose. Although a significant hazard is not currently associated with this practice, risk could increase during the long-term storage of chemicals if facilities are not upgraded and properly maintained. As demonstrated by the field verification review, some storage practices need to be upgraded, including those for uranium hexafluoride cylinders, 1-ton chlorine cylinders at a water treatment plant, and chemicals in laboratories.

All sites have developed strong Resource Conservation and Recovery Act (RCRA) waste management programs and, with few exceptions, practices conform to requirements. Wastes are characterized before disposition, usually through sampling and analysis, although historical values are used in some repetitive situations. Qualified personnel review analyses and establish handling requirements to ensure proper disposition. With one exception, all RCRA and mixed-waste drum storage areas reviewed by the team demonstrated exemplary compliance with regulations and site requirements.

All sites have or will complete comprehensive surveys of water drainage systems and discharges. The surveys are used (1) to ensure proper routing of process discharges, building drains, stormwater drains, and sanitary wastes; (2) to reduce point source discharges; and (3) to evaluate opportunities for source reduction. Similar surveys of air emission points are also being undertaken-primarily in response to forthcoming permit requirements specified under Title V of the Clean Air Act Amendments. These surveys can be used as a basis for minimizing the number of vents and stacks.

In summary, inventories of hazardous chemicals in most Oak Ridge facilities are well characterized, except for those in some shutdown facilities. The use of HMIS for inventory control is considered a good practice, as is a similar computer-based bar-coding system for hazardous wastes. The efforts in some facilities to find **uses for excess chemicals are also** commendable. The chemical inventory in storage is stable and presents few unusual hazards; however, extended storage will result in increased risk as containers and facilities deteriorate further. Hazardous materials in laboratory facilities also represent a vulnerability to the extent that these facilities are allowed to operate with less rigorous procedures than those required for some other facilities. The casual handling practices and only fair housekeeping conditions that exist in some laboratories are not consistent with the objectives of site procedures or with DOE 5480.19, “Conduct of Operations Requirements for DOE Facilities,” or 29 CFR 1910.1450, “Occupational Exposure to Hazardous Chemicals in Laboratories.” (See Vulnerabilities CSVR-OR-ORR-02 and CSVR OR-ORR-04.)

2.2 **Facility Physical Condition**

Verification activities for the facility physical condition functional area of the Chemical Safety Vulnerability Review for K-25, Y-12, and ORNL included all pertinent lines of inquiry. All facilities included in the site self-evaluations were reviewed. Selected additional facilities at each site were reviewed whenever further information was needed to validate the results.

In general, the facilities visited at the three Oak Ridge sites appeared to be structurally and mechanically sound, although they do not fully comply with the engineering requirements for new facilities. In the recent past, several facilities have been reroofed to eliminate chronic water leaks. Other buildings have leaking roofs that need to be replaced, but Condition Assessment Surveys (CASS) have not been performed. For that reason, reroofing projects may not have received the appropriate funding. Delay of roof repairs could result in leaks and potential migration of residual chemicals in some Oak Ridge facilities.

Several facilities are inactive or undergoing D&D of process and process-related equipment. To maintain a safe work environment during D&D of process systems containing hazardous chemicals, these facilities are in need of preventive and corrective maintenance, periodic

upgrades to infrastructure systems, and updated configuration drawings. A plan for the surveillance and maintenance for the D&D of facilities was published in December 1992. Because of the long lead time required for capital projects, CASS should be completed as soon as possible to identify required facility and infrastructure upgrades. This is particularity true when CASS are required before submission of project requests.

Based on the limited sample of corrective maintenance data for the facilities reviewed, about one-third of all open work orders are more than 90 days old. Some current work orders are not scheduled for completion until December 1994. However, at the time of this review the backlog did not include safety-related work orders.

The changing mission of Oak Ridge facilities also contributes to the need to modify and upgrade projects in a manner that will enhance safe operation. For example, during the winter of 1993–94, the testing and flushing of the fire-suppression system in the K-25 Process Building from a wet-pipe to a dry-pipe system resulted in significant freeze damage, This damage was caused by the absence of low-point drains in the piping. System modifications are required to prevent recurrences of this kind.

Some industrial facilities converted for administrative use do not meet current engineering standards. For example, many are equipped with obsolete fluorescent light fixtures containing small quantities of polychlorinated biphenyls (PCBS). The construction of the ballast does not provide for the containment of PCBS when a failure occurs. As a result, PCBS can drip onto personnel, furniture, or floors and be tracked to adjacent areas. Most facilities have been maintained in good condition. However, some facilities currently used for storage could result in a medium-priority vulnerability with a potential for long-term consequences. (See Vulnerability CSVR-OR-ORR-02.)

2.3 **Operational Control and Management Systems**

Operational controls and management systems were examined as part of the site visit. Although MMES has put in place an extensive array of policies and procedures related to safe management of hazardous materials, chemical safety vulnerabilities have been identified and, in part, are traceable to (1) lack of explicit sitewide guidance on controlling activities after operations have ceased (but before D&D has begun), (2) some instances where implementation of guidance could be strengthened, or (3) low priority for funding.

Each of the self-evaluation reports compiled by MMES contains a summary of program and management systems currently in place to control chemical safety vulnerabilities. MMES has implemented a management structure in which a central organization develops procedures that are generally applicable to ORN L, Y-1 2, and K-25. In addition, each of the three sites can, and often does, develop its own procedures to deal with plant-specific matters. Some buildings and programs have developed yet another layer of analyses and operational controls.

These systems provide the basis for control of hazardous material during routine operations, in accordance with DOE 5480.19 and related documents, and for control of hazardous wastes, in accordance with the detailed requirements developed for RCRA; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the Toxic

Substances Control Act (TSCA). Historically, specific procedures have not been developed (or required) to provide close control over facility shutdown and cleanout or for surveillance and maintenance (S&M) prior to D&D. The implementation of management systems for such activities has been left to the discretion of each site, and implementation of good practices varies widely.

The MMES approach of using both corporate-wide and site-specific procedures provides a mechanism to ensure that all stages of the life cycle of an operation are treated with an appropriate degree of rigor, while providing flexibility for dealing with individual needs. The strength of the approach depends on the actual requirements imposed by the corporate-wide procedures and on the care exercised in assessing the vulnerabilities attending with specific activities.

As noted elsewhere, there are substantial differences in the actual implementation of systems and procedures important to chemical safety that can be traced back to fundamental differences between the sponsoring program offices at DOE Headquarters. Nonetheless, it should be noted that MMES has adopted good practices by specifically requiring that "efforts to ensure the safety of . . . operations shall be applied in ail stages of the life cycle of these operations" (e.g., Y70-81 1, "Safety of Operations," dated March 1, 1993). In recent years, a substantial effort has been made to apply this global approach to processes used for evaluating and reducing hazards.

Other management systems, such as those related to conduct of operations and maintenance, are still evolving. The February 18, 1994, Y-1 2 letter from D. Bostock to R.J. Spence of OR provides a detailed status report of efforts to implement DOE 5480.19. CASS per DOE 4320.2A, "Capital Asset Management Process," issued February 10, 1994, are being aggressively implemented at Y-12. Thirty-three facility surveys had been completed, with another 17 in process at the time of this review. The assessment process has also been initiated at ORNL. Five facility surveys have been completed, and 10 are scheduled to start before the end of fiscal year (FY) 94. Surveys have not begun at K-25 but are scheduled to start early in FY 95.

Specific procedures that apply to facility shutdown and cleanout have not been developed. For example, the MMES-wide document ESS-OP-1, "Standard for Conduct of Operations," dated March 21, 1991, has a section on performance objectives and criteria, but it provides no guidance on dealing with facility shutdown and cleanout, S&M, or D&D. The MMES Environment, Safety and Health Strategic Plan (ES/ESH/lNT-2, Revision 1, dated August 1993) compounds this shortcoming by separating information on cleanup operations from the section emphasizing engineered barriers.

On the other hand, requirements for detailed management planning for D&D efforts funded by the DOE Office of Environmental Management appear to be widely used (e.g., tVPM-18, "K-25 Site Decontamination and Decommissioning Surveillance and Maintenance Annual Report FY 1993," dated November 15, 1993, and Y/ER-60, "Project Management Plan for the Decontamination and Decommissioning of Building 9201-4 at the Oak Ridge Y-12 Site," dated December 1993). Most of these documents have their widest application to new efforts and projects.

A more complete discussion of operational controls and management systems, and of their relevance to chemical safety vulnerabilities, can be found in Appendix E (for Y-12) and Appendix F (for ORNL) of DOE/EH-0282, "Task Group Report to the Assistant Secretary for Environment, Safety and Health on Oversight of Chemical Safety at the Department of Energy," dated November 1992.

In summary, MMES has an impressive array of new operational controls and improved management systems that can be used to reduce or eliminate chemical safety vulnerabilities. There is no explicit requirement to address these issues when operations are terminated or when the use of older, noncompliant facilities is continued (see the chemical safety vulnerabilities discussed in Section 3.2). When engineered barriers are known to be weak or nonexistent, engineered solutions should be sought in lieu of long-term administrative controls.

2.4 **Human Resource Programs**

Verification activities for the human resource programs functional area of the Chemical Safety Vulnerability Review at Oak Ridge included all elements of the lines of inquiry, with particular emphasis on issues related to training, staffing, employee involvement, and visitor and subcontractor control. No explicit chemical safety vulnerability issues related to human resource programs were identified for Y-1 **2, K-25,** or ORNL.

Each of the three sites at Oak Ridge provides training to its employees through its own training organizations. In addition, workers directly involved in hazardous waste operations conducted at treatment, storage, and disposal facilities regulated by RCRA (i.e., through 40 CFR 264 and 40 CFR 265) receive initial 40-hour hazardous waste operations (HAZWOPER) training through the three Oak Ridge labor unions under a National Institute of Environmental Safety and Health (NIEHS) program. Eight- and 24-hour refresher training is provided by each site's MMES training organization. The training provided meets Occupational Safety and Health Administration (OS HA) requirements stipulated in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." MMES systems are in place to ensure that workers receive refresher training in a timely manner. All HAZWOPER workers contacted (including both MMES and subcontractor personnel) were aware of the need for and contents of the training. All training cards examined were complete and current.

Training provided to site personnel on the requirements of 29 CFR 1910.1200, "Hazard Communications," and 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories," was also examined. All MMES and subcontractor personnel receive basic hazard communication training as part of their general employee training package. The purpose of this training is to acquaint all personnel with the pertinent statutory requirements for hazard communications, as well as to familiarize them with warning labels, signs, and MSDSS. All site personnel are also trained on the MMES Reproductive Hazards Protection Program. Other specialized training is provided to supervisors, personnel working with carcinogens, or wearers of respiratory protection equipment. Retraining is facilitated through the use of a computerized system at all three sites. With only one exception (i.e., an instance in which an individual's carcinogen control training had lapsed), all personnel interviewed had appropriate training that was current.

MMES is promoting a high level of worker awareness for safety issues involving chemicals. In addition to formal training, a proactive campaign (including promotional materials and special events) is in place to foster awareness of chemical safety and hazardous communications issues. ORNL is also developing an interview form that will test worker knowledge of chemical hazards in the workplace. This form will be used to document worker understanding of the chemical hygiene program at ORNL during routine industrial hygiene walkthroughs of facilities.

In summary, MMES has the necessary human resource systems to meet both DOE and OSHA requirements in the area of chemical safety. Staffing levels directly associated with chemical safety issues have increased substantially since the three sites have transitioned to environmental restoration and waste management projects. Personnel involved in these projects are well trained, motivated, and cognizant of chemical hazards in their workplace. This level of training and chemical safety awareness is still maturing within research facilities at the three sites.

2.5 **Emergency Management Program**

Verification activities for the emergency preparedness program functional area of the Chemical Safety Vulnerability Review for the Y-1 2, K-25, and ORNL sites at Oak Ridge included all elements of the lines of inquiry. All facilities included in the site self-evaluations were reviewed. Selected additional facilities at each site were reviewed whenever further information was needed to validate the results.

Emergency management programs at the three Oak Ridge sites mirror the requirements of the DOE 5500 series of Orders. Each of the three sites has developed an overall sitewide emergency plan, augmented by individual facility-specific emergency manuals or procedures for significant facilities. These plans, manuals, and procedures address multiple types of events, including chemical hazards, radiological and criticality incidents, and natural phenomena, The plans were developed using the results of a maturing hazards identification and analysis program that also supports the development and refinement of facility safety analysis reports. The level of effort and thoroughness invested in the hazards screening and analysis process, especially at K-25, is considered a commendable practice that should be emulated across the DOE complex.

In addition to these broad-based plans, the Oak Ridge sites have developed topic-specific plans on an as-needed basis (e.g., oil spill plans, hazardous materials plans). Coordination with offsite authorities and organizations is evident in the various response plans, particularly with the State of Tennessee Emergency Plan for Hazardous Material Events at DOE/Oak Ridge Facilities.

For accident consequence assessments in the hazardous materials area, the sites use the Air Force Toxic Chemical Dispersion Model, the Air Force Dispersion Assessment Model, and the Hazardous Atmospheric Release Model developed by the National Oceanic and Atmospheric Administration, with DOE sponsorship. All three sites have recently upgraded their meteorological towers and other provisions for acquiring real-time meteorological data. However, one possible area of concern involves the accuracy of these predictive models for the extremely complex terrain and micrometeorology of the Oak Ridge area. The sites are

encouraged to explore the possibility of conducting confirmatory tracer studies and/or other measures to validate the codes for their sites and for the chemicals of particular interest for their operations.

The emergency plans reflect the development of extensive evacuation planning for both workers and the public. Notification of offsite authorities is addressed, as is the use of audible alert and notification systems for the public. The plans also address employee training and employee assembly and accountability during an actual event. During facility walkdowns, team members noted the extensive attention provided to these issues as exemplified by the number and highly visible nature of assembly areas throughout the three sites. Team members also noted the general availability of eye-wash stations, emergency showers, and personal protective equipment in most locations where they might be needed.

Facilities and equipment necessary for response to hazardous materials incidents are generally available, but the quality and condition of the equipment vary from site to site. Within the past 2 years, the Y-12 Site acquired a specially designed hazardous material response vehicle that is a fire-utility type truck and will support response operations up through and including Class A chemical suits. The K-25 Site also has a similar, but somewhat older, hazardous material response vehicle. Response vehicles and equipment at ORNL are not as up-to-date but are generally considered adequate. Response personnel are trained in those skills necessary to function safely during a hazardous material incident.

Exercises and drills are an integral part of the emergency management program and are adequately addressed at all three sites. Annual training is made available to offsite authorities and response organizations, as is the opportunity to participate in appropriate drills and exercises.

Although the overall state of emergency preparedness has not been identified as a significant vulnerability from the standpoint of this review, the overall level of maturity, thoroughness, and rigor of these programs varies considerably from site to site, with K-25 clearly in the lead and with ORNL placing a distant third. The K-25 Site leads its sister sites in part because of concurrent improvements developed and implemented (1) in response to the significant deficiencies in emergency preparedness identified during the EH Technical Safety Appraisal conducted in 1989 and (2) in association with the regulatory requirements for startup of the TSCA Incinerator. It should also be noted that all three sites have shown significant improvement in their emergency preparedness programs over the past few years.

3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES

3.1 Criteria

A vulnerability is defined as a weakness or potential weakness involving hazardous chemicals that could result in a threat to the environment, the public, or worker health and safety. Vulnerabilities can be characterized by physical or programmatic conditions associated with uncertainties, acknowledged deficiencies, and/or unacknowledged deficiencies in the area of chemical safety. Conditions required to create the vulnerability should either currently exist or be reasonably expected to exist in the future based on degradation of systems and chemicals or through expected actions (e.g., D&D of a facility within 2 years).

A vulnerability will be determined to exist if current or expected future conditions or weaknesses could result in either of the following:

- The death of or serious physical harm[2] to a worker or a member of the public or the continuous exposure of a worker or member of the public to levels of hazardous chemicals above hazardous limits: or

- Environmental impacts resulting from the release of hazardous chemicals above established limits.

The prioritization of chemical safety vulnerabilities is based on the professional judgment of team members concerning the immediacy of the potential consequences posed by each vulnerability and on the potential severity of those consequences. The first step in the prioritization process was to group vulnerabilities according to the timeframe in which they are expected to produce consequences. The following categories have been established for the timeframe within which the consequences are expected to occur:

- Immediate — Any chemical safety vulnerability that could result in immediate consequences.

- Short-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- Medium-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3–1 O-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- Long-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a timeframe of more than 10 years as a result of

[2] Serious physical harm is defined as impairment of the body, leaving part of the body functionally useless or substantially reducing efficiency on or off the job.

chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

Vulnerabilities within each category should be further prioritized to specify “high,” “medium,” or “low” priority based on the severity of the potential consequences. Examples of the second level of prioritization include the following:

- Prioritize potential harm to workers or the public according to the possible level of injury and/or health effect, ranging from transient reversible illness or injury to death.

- Prioritize environmental impacts based on the level of irreversible damage and/or restoration costs.

3.2 **Chemical Safety Vulnerabilities at the Oak Ridge Reservation**

The chemical safety vulnerabilities identified in this section were derived from the self-evaluation data and from specific observations made during the field verification process. Five vulnerabilities were identified at Oak Ridge as a result of this review.

CSVR-OR-ORR-01: **Uncharacterized areas containing potentially hazardous materials are increasingly accessible.**

Security areas at the Oak Ridge sites are shrinking as programs are cut back. The costs of maintaining such areas are high, and the Department’s increased openness promotes reduction in controlled areas, consistent with changing missions. Other access control measures, both administrative and physical, will diminish over time. At Oak Ridge, all facilities and operations have been subjected to at least a preliminary hazards screening. However, excess and abandoned facilities/sites that may not have been fully evaluated and characterized will become available for access by workers and the public. As this occurs, many individuals will not know the history of the facility/site, nor will they be aware of the real or potential hazards that may be present. The possible exposure of workers and the public to hazardous and/or toxic materials, environments, and situations without their knowledge or consent represents a high-priority vulnerability with a potential for short-term consequences.

CSVR-OR-ORR-02: **Chemicals are stored in facilities not designed for that purpose.**

Buildings and equipment are being used for purposes for which they were not intended or beyond their expected life. Some cylinders used for storing uranium hexafluoride have failed in the recent past, releasing small quantities to the atmosphere. The process of aging will accelerate as cylinders reach the end of their functional life. The storage of 23.6 million pounds of lithium hydroxide-plus smaller quantities of low-level radioactive waste, other hazardous chemicals, and chemical residuals—in steel drums represents another potential hazard. Storage areas currently being used have no climate control; thus, the drums are subject to the long-term effects of corrosion due to diurnal and seasonal extremes of temperature and humidity. Projects for storage facilities have been proposed but have not been funded. These conditions and circumstances represent a medium-priority vulnerability with a potential for medium-term consequences.

CSVR-OR-ORR-03: Facilities were placed in caretaker status without appropriate cleanup or documentation.

When a facility changes from operational to caretaker status without thorough cleanup operations, chemicals left in the facility can represent a potentially hazardous condition and/or environmental concern. Such chemicals may be hazardous in their original state or as degradation products that result over time. Chemicals and/or their degradation products may also cause damage to equipment or structures or be affected by building or container deterioration due to natural aging. The loss of corporate memory (e.g., as a result of personnel transfers and retirements, facility aging, downsizing, multiple usage, and inadequate configuration management and recordkeeping in the past) may result in chemical hazards when new operations are attempted. The potential for fire, employee exposure, inadvertent releases to the atmosphere, and higher cleanup costs represents a medium- to high-priority vulnerability with a potential for short- to long-term consequences.

CSVR-OR-ORR-04: Inconsistent formality and rigor are applied to the management of hazardous materials.

Use of the Hazardous Materials Information System for chemical inventories is an effective tool for enhancing safety and control, but it is not used in all facilities at Oak Ridge. Chemical inventories (e.g., lithium hydroxide, uranium hexafluoride) in long-duration storage are currently stable and pose normal industrial hazards, but the risk could increase during extended storage as containers and facilities deteriorate. Funds requested to upgrade storage conditions have not been obtained. Funds have been proposed to upgrade storage conditions, but in the absence of regulatory drivers, some projects have not had sufficient priority. Hazardous materials in some laboratories are excluded from the more rigorous controls specified for some other facilities. Casual handling and housekeeping practices in some laboratories are inconsistent with site procedures, DOE 5480.19, and 29 CFR 1910.1450. These conditions and circumstances represent a medium-priority vulnerability with a potential for short- to long-term consequences.

CSVR-OR-ORR-05: Large quantities of specialty and other industrial chemicals are stored without consistent strategic planning.

This potential vulnerability involves the storage of bulk quantities of unique chemicals that are now surplus to national defense programs. Chemicals stored at Y-12 and K-25 include lithium and its compounds, beryllium and its compounds, uranium hexafluoride, and mercury. Over time, unanticipated chemical hazards may result from the storage of these chemicals in temporary facilities. Chemical aging, which degrades the material to unknown byproducts, represents another potential hazard. The storage of this material also represents a long-term economic commitment by DOE. These conditions and circumstances represent a medium-priority vulnerability with a potential for medium- to long-term consequences.

Information from the ongoing Surplus Facilities Inventory Assessment and the extended review of facilities in which there may be organic-nitrate vulnerabilities (as occurred at Tomsk-7) will also be considered. Work products from these activities will be reviewed and may provide additional insights on potential chemical safety vulnerabilities.

Attachment 1

TEAM COMPOSITION

Area of Responsibility	Name/Organization
Team Leader	Victor 1. Crawford Office of Environmental Audit U.S. Department of Energy
Management/Operations	Del Bunch Management Strategies, Inc.
Management/Training	John A. Leonowich Battelle, Pacific Northwest Laboratory
Chemical Process Safety	John A. Porter JP Techsewices, Inc.
Industrial Hygiene	Paul W. Hoffman Westinghouse Waste Isolation Division
Environmental Protection	Richard R. Lunt Arthur D, Little, Inc.
Maintenance	David R. Spence Technical and Professional Services
Emergency Management	David M. Rohrer Office of Health U.S. Department of Energy
Site Liaisons	Mark Robinson Oak Ridge Operations Office US. Department of Energy
	David Sheffey Martin Marietta Energy Systems
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ATTACHMENT 2

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: April 23.1994

Site/Facility:	Oak Ridge
Vulnerability Number:	CSVR-OR-ORR-01
Functional Area(s):	Operational Control and Management Systems, Identification of Chemical Holdings, Facility Physical Condition

1. Brief Description of Vulnerability.

Uncharacterized areas containing potentially hazardous materials are increasingly accessible,

2. Summary of Vulnerability.

Security areas at the Oak Ridge sites are shrinking as programs are cut back. The costs of maintaining such areas are high, and the Department's increased openness promotes reduction in controlled areas, consistent with missions, Other access control measures, both administrative and physical, will diminish over time. At Oak Ridge, all facilities and operations have been subjected to at least a preliminary hazards screening. However, excess and abandoned facilities/sites may not have been fully evaluated and characterized, and some will become available for access by workers and the public, Those individuals will not know the history of the facility/site, nor will they be aware of the real or potential hazards that may be present.

3. Basis.

a. Requirements: The health and safety of workers and the public must be protected from both past and present activities involving hazardous materials.

b. Chemicals Involved: The full range of hazardous materials available over the entire operational life of the facility/site, including organic solvents, lead-based paints, acids, bases, exotic chemicals, carcinogens, and heavy metals.

c. Relevant Self-Evaluation Data:

- The self-evaluation addressed the fact that the K-1 070A Burial Ground at K-25 is known to contain chemicals, but records of specific types and quantities were not known, Organic chemicals and heavy metals **have been detected in the groundwater monitoring wells surrounding the Burial Ground, indicating that hazardous materials are migrating from the burial ground.**
- **The self-evaluation for the 9201-4 Process Building identified the presence of asbestos, lead paint, polychlorinated biphenyls, and mercury, and characterizations are under way for all such materials at the facility. The characterization of the residual mercury problems at Y-12 has been the subject of continuing studies since the "1983 Task Force Study, " which focused on mercury contamination at the Y-12 Site.**

d. Contributing Causes:

- **Loss of corporate** memory **due to personnel transfers and retirement**
- **Multiple uses of facilities/sites over time**
- Aging of chemicals and possible interactions with their surroundings
- Decreased budgets requiring expanded cost-saving measures
- Lack of appropriate resources for the orderly shutdown of and withdrawal from excess facilities.

e, Potential Consequences: The possible exposure of workers and the public to hazardous and/or toxic materials, environments, and situations without their knowledge or consent represents a high-prioriiy **vulnerability with a potential for short-term consequences.**

Site/Facility:	Oak Ridge
Vulnerability Number:	CSVR-OR-ORR-01
Functional Area(s):	Operational Control and Management Systems, Identification of Chemical Holdings, Facility Physical Condition

4. Supporting Observations.

- Burial grounds (e.g., K-1 070-A and ORNL/Contractor Landfill [7658 area]) are characterized **only generally, and their potential hazards to the public are not known with any** degree of accuracy. Funding for full characterization has been diverted to higher priority projects. Over time, the contents and history of the site could be forgotten.
- Hazardous materials deposits or residues remain in the process equipment and piping of numerous excess or inactive facilities, such as the Gaseous Diffusion Building (K-25), the K-725 Storage Warehouse (K-25), the 9201-4 Production Building (Y-12), and the Radiochemical Development Laboratory (ORNL).
- In the past, hazardous materials have escaped from buildings and have contaminated the soil around and beneath some buildings (e.g., the 9201-4 Production Building at Y-12).
- Past operational practices involving the disposal of chemicals into building drains may have leaked hazardous materials to the soil, which has not been characterized for contaminants.
- Access on unlocked, unguarded roads in the vicinity of landfills and work areas is no longer rigorously controlled.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: April 22, 1994

Site/Facility: Oak Ridge/(Y-l 2, K-25)

Vulnerability Number: CSVR-OR-ORR-02

Functional Area(s): Operation Control and Management Systems, Facility Physical Condition

1. Brief Description of Vulnerability.

Chemicals are stored in facilities not designed for that purpose.

2. Summary of Vulnerability.

Funding requested for some dedicated storage facilities has not been provided. Therefore, the use of less-than-adequate facilities has been required. Drums could corrode, releasing chemicals to the environment and//or causing potential worker exposures. Cylinders containing uranium hexafluoride are stored outside and are exposed to the elements. Severely corroded cylinders have released uranium hexafluoride to the environment. Additional cylinder failures are expected to cause more uranium hexafluoride releases. A plan currently exists to demolish Building 9201-4 at some time in the future. In the interim, the building could be used for storage. Future use of the facility may not be consistent with the potential hazards associated with residual levels of mercury and other facility limitations.

3. Basis.

a. Requirements:
- DOE 4320.2A
- DOE 4330,4B

b. Chemicals Involved:
- Lithium hydroxide
- Uranium hexafluoride
- Mercury

c. Relevant Self-Evaluation Data: Self-evaluation responses cited management documents and control systems that are in place for selected facilities.

d. Contributing Causes:
- Adequate resources have not been provided for chemical storage.
- Formal policies for the use or disposal of excess chemicals have not been developed.

e, Potential Consequences: The continued deterioration of drums and cylinders could result in the release of chemicals and the possible exposure of workers to caustics or irritants. Releases and possible worker exposures are expected to increase in frequency as containers reach the end of their useful lives. These conditions and circumstances represent a medium-priority vulnerability with a potential for medium-term consequences.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 2) DATE: April 22, 1994

Site/Facility:	Oak Ridge/(Y-l 2, K-25)
Vulnerability Number:	CSVR-OR-ORR-02
Functional Area(s):	Identification of Operation Control and Management Systems, Facility Physical Condition

4. Supporting Observations.

- Lithium hydroxide drums were observed stored in the lower level of the K-25 Process Building.
  - No consistent policy was used for stacking drums.
  - Storage facilities do not have adequate temperature or humidity controls.
  - Significant corrosion was evident on the exterior of many drums.
  - Deteriorated wooden pallets could fail, causing one or more drums to rupture and spill lithium hydroxide.
  - Potential personnel exposure to lithium hydroxide could occur, resulting in caustic burns.

- Cylinders containing uranium hexafluoride are stored outside and are exposed to the elements.
  - Failure of cylinder walls **due to corrosion has resulted in uranium hexafluoride leaks.**
  - **No secondary containment is used** in storage areas.

- The Alpha-4 facility may be used for chemical storage in the future.
  - Cleanup acceptance criteria based on future use have not been established.
  - Future uses that are not consistent with residual mercury, facility characteristics, and environmental conditions could result in a chemical safety vulnerability.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: **April** 22, 1994

Site/Facility: Oak Ridge

Vulnerability Number: CSVR-OR-ORR-03

Functional Area(s): Identification of Chemical Holdings, Facility Physical Condition

1. Brief Description of Vulnerability.

Facilities were placed in caretaker status without appropriate cleanup or documentation

2, Summary of Vulnerability.

When a facility changes from operational to caretaker status without thorough cleanup operations, chemicals left in the facility can represent a potentially hazardous condition and/or environmental concern. Such chemicals may be hazardous in their original state or as degradation products that result over time. Chemicals and/or their degradation products may also cause damage to equipment or structures or be affected by building or container deterioration due to natural aging. The loss of corporate memory (e.g., as a result of personnel transfers and retirements, facility aging, downsizing, multiple usage, and inadequate configuration management and recordkeeping in the past) may result in chemical hazards when new operations are attempted,

3. Basis,

a. Requirements:
- DOE 4330.4B
- Good Practices

b. Chemicals Involved: The full range of hazardous materials over the entire operational life of the facility/site, including organic solvents, lead-based paints, acids, bases, exotic chemicals, carcinogens, and heavy metals,

c. Relevant Self-Evaluation Data: Self-evaluation responses cited management documents and control systems that are in place for selected facilities,

d, Contributing Causes:
- Adequate resources have not been provided for shutdown and withdrawal from facilities or for acquiring and maintaining historical records as part of the shutdown process.
- Changing facility missions prevent realistic projections for long-term use.

e. Potential Consequences: The potential for fire, employee exposure, inadvertent releases to the atmosphere, and higher cleanup costs represents a medium- to high-priority vulnerability with a potential for short- to long-term consequences.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 2) **DATE: April 22, 1994**

Site/Facility: **Oak Ridge**

Vulnerability Number: **CSVR-OR-ORR-03**

Functional Area(s): **Identification of Chemical Holdings, Facility Physical Condition**

4. Supporting Observations.

- **Visual observation and document reviews indicate that vaults for storage of various materials at K-25 need repair or rehabilitation.**
- **Limited capability to remove contaminated equipment from K-25 and elsewhere reflects insufficient management controls over the decontamination and decommissioning process. Although Freon, lubricating oils, and uranium hexafluoride have been removed from process equipment, deposits and/or residues remain in place (including trace quantities of technetium and plutonium, as well as more substantial quantities of uranium). The presence of such materials limits removal efforts.**
- **Building K-725 was abandoned years ago without a cleanup. The building and, in particular, the ductwork are known to be contaminated with hazardous chemicals. Warning signs are posted around the building.**
- **The shielded cell facility in Building 3047 at ORNL contains a sealed sump that is known to contain a radioactive residue. The manner in which the material reached the sump is unknown, but it may have been conducted through a ventilation duct or via a pipe leak. No device is in place to sample or flush the sump; thus, the sump contents are unknown. Chemical processing is no longer conducted in the cells. In the past, work in the cells involved acids, bases, solvents, and other materials that may still be in the sump. The hazards associated with the sump contents are thus unknown.**
- **Chemical safety vulnerabilities have resulted from the termination of the isotope separations program without a corollary for cleanout of hazardous materials at ORNL.**
- **Characterization of building contamination has been difficult to complete, especially for mercury residuals at Y-12.**

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: April 21,1994

Site/Facility: Oak Ridge

Vulnerability Number: CSVR-OR-ORR-04

Functional Area(s): Identification of Chemical Holdings, Operational Control and Management Systems

1. Brief Description of Vulnerability.

Inconsistent rigor and formality are applied to managing hazardous materials.

2. Summary of Vulnerability.

In the absence of specific DOE Orders and/or regulatory requirements, procedures and the conduct of operations related to handling and storing hazardous materials are not uniform between sites and, in some cases, between divisions and facilities within the same site.

3. Basis.

a. Requirements:
- 29 CFR 1910.1450
- DOE 5400.1
- DOE 5480.10
- DOE 5480.19
- K-25 SPP 4111
- X-1 O IS-3,1 (Rev. 1)
- ESS-IH-140

b. Chemicals Involved: Many types and quantities of hazardous materials for activities that include long-term, large-scale storage; laboratory use and storage; and operations. Predominantly “second-tier” hazardous materials (HM categories 1 through 3) are involved.

c. Relevant Self-Evaluation Data: Self-evaluation responses cited management documents and control systems that are in place for selected facilities.

d. Contributing Causes:
- Lack of specific and/or prescriptive DOE Orders
- Lack of specific and/or prescriptive regulatory requirements
- Low funding priori for hazardous materials storage
- Inconsistent management commitment

e. Potential Consequences: The most Iikely environmental impacts would be localized spills that could involve reportable quantities, although offsite migration could occur. Residual environmental risks or liabilities could result. Injuries and other impacts to worker safety and health would likely be localized. These conditions and circumstances represent a medium-priority vulnerability with a potential for short- to long-term consequences.

Site/Facility: Oak Ridge

Vulnerability Number: CSVR-OR-ORR-04

Functional Area(s): Identification of Chemical Holdings, Operational Control and Management Systems

4. Supporting Observations.

(a) Lithium hydroxide from Y-12 has been stored at K-25 by two different organizations. Storage is located in controlled access areas, but storage conditions are not consistent with "good management practices." Requested funds to upgrade storage conditions have not been obtained.

- Storage Facility Condition
  - – Lack of maintenance for heating, ventilation, air-conditioning, and fire protection systems has resulted in water leaks.
  - – Eyewash stations and/or safety showers have not been installed at the storage areas.
  - – Inadequate housekeeping was noted (e.g., dirty floors, discarded banding).

- Drum Stacks
  - – Pallets were stacked three high (four drums per pallet) in some areas. Some drum sets are not banded and some wooden pallets are cracked, causing stacks to tiff slightly. The three-high stacks were reported to be early placements, and this practice is no longer followed.

- Drum Conditions
  - - Not all drums were properly labeled.
  - – Some drums showed significant exterior corrosion.
  - – Lid lock-down band on one drum was observed to be loose.

- Inspections
  - – A monthly inspection program has been instituted, but there **is no evidence that drum corrosion is monitored. Inspections have not triggered timely corrective actions for labeling or to upgrade conditions.**

(b) Examples of improper handling and storage of hazardous chemicals in laboratories and other conditions that are inconsistent with 29 CFR 1910.1450 were observed:

- Flammables, carcinogens, and corrosive chemicals stored in the same cabinet;
- Ethers not analyzed for peroxides, bottles not dated, and bottles not stored in an explosion-proof refrigerator;
- Incompatible chemicals placed in an open, improperly labeled RCRA satellite storage "area" (container);
- Inadequate housekeeping practices in some areas; and
- No potable water and no eyewash or safety shower station at one laboratory.

(c) Storage of uranium hexafluoride containers–see Vulnerability CSVR-OR-ORR-05.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM **DATE: April 22, 1994**

Site/Facility: **Oak Ridge (Y-1 2/K-25)**

Vulnerability Number: **CSVR-OR-ORR-05**

Functional Area(s): **Identification of Chemical Holdings**

1. Brief Description of Vulnerability.

Large quantities of specialty and other industrial chemicals are stored without consistent strategic planning.

2. Summary of Vulnerability.

The national defense mission of DOE prompted the purchase and stockpiling of industrial quantities of many unique chemicals. Because of changing strategic requirements, most of these chemicals are now surplus to DOE needs. The storage of these chemicals could result in unanticipated vulnerabilities caused by the absence of appropriate controls, chemical aging, and decomposition to unknown byproducts. It also represents the need for a long-term economic commitment by DOE.

3. Basis.

a. Requirements: There are no statutory regulations explicitly covering the long-term, "caretaker" storage of bulk industrial chemicals, either in DOE or Federal regulations.

b. Chemicals Involved: Lithium and lithium compounds, uranium hexafluoride, beryllium and beryllium compounds, and mercury.

c. Relevant Self-Evaluation Data: Self-evaluation responses cited management documents and control systems that are in place for selected facilities.

d. Contributing Causes:

- **Lack of Federal/DOE regulatory requirements**
- **Lack of a definitive, long-term policy on the disposition of this excess material.**
- **Lack of research and detailed knowledge on "aging chemicals"**
- **Uncertainty of future requirements for stockpiling chemicals**

e. Potential Consequences: Significant quantities of potentially toxic or corrosive materials could be released to the environment as the chemicals in these materials age, The potential health effects of such aging on workers and the public are difficult to quantify. These conditions and circumstances represent a medium-priority vulnerability with medium- to long-term consequences.

Site/Facility:	**Oak Ridge (Y-12/K-25)**
Vulnerability Number:	CSVR-OR-ORR-05
Functional Area(s):	**Identification of Chemical Holdings**

4. **Supporting Observations.**

- **A number of the facilities visited stored large quantities of chemicals:**
  Industrial quantities of lithium and its compounds (Y-12 and K-25).
  Beryllium and its compounds (in Building 9201-5 at Y-12).
  Mercury (in Building 9201-4 at Y-12).

- **Uranium hexafluoride is stored at a number of areas at K-25. The total amount (from the site emergency plan) is estimated at more than 50,000 tons. This material is stored in several yards, generally segregated by size of containers and contents. These yards are fenced, and access is controlled. However, these areas lack engineered controls to minimize the potential for environmental releases, and the conditions of the yards and containers are deteriorating. This has necessitated reliance on administrative controls (e.g., inspections and testing for container integrity).**
  Most of the containers are placed on concrete pads, with full containers set on wooden saddles. There are numerous instances, however, where saddles have deteriorated or broken and areas where concrete has deteriorated.
  - **Many containers show evidence of excessive corrosion. A number of containers have leaked, and some may still be leaking.**
  The yards do not have containment or catch basins to control runoff.

- **There have been attempts to sell some surplus material (particularly lithium compounds) on the open market. Bids received for this material have been well below market value. MMES is attempting to dispose of lithium and beryllium to commercial vendors.**

- **A definitive, long-term policy on the disposition of this excess material is lacking.**

- **See Vulnerabilities CSVR-OR-ORR-02, CSVR-OR-ORR-03, and CSVR-OR-ORR-04.**

ATTACHMENT 3

SELECTED ACRONYMS

CAS	Condition Assessment Survey
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EH	DOE Office of Environment, Safety and Health
HAZWOPER	Hazardous Waste Operations
MMES	Martin Marietta Energy Systems
MSDS	Material Safety Data Sheet
OR	Oak Ridge Operations Office
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act of 1976
TSCA	Toxic Substance Control Act of 1976